

for a rotationally symmetric paraboloid

$$z - z_0 = a((x - x_0)^2 + (y - y_0)^2)$$

you can pick a new set of parameters to make this linear!

$$(x - x_0)^2 = (x - x_0)(x - x_0) \\ x^2 - 2xx_0 + x_0^2$$

$$z - z_0 = a(x^2 - 2xx_0 + x_0^2) + a(y^2 - 2yy_0 + y_0^2) \\ = ax^2 - 2axx_0 + \underbrace{x_0^2}_{\text{}} + ay^2 - 2ayy_0 + \underbrace{y_0^2}_{\text{}}$$

$$z = \underbrace{a}_{a=a} (x^2 + y^2) - \underbrace{2ax_0x}_{c_3} - \underbrace{2ay_0y}_{c_2} + \underbrace{x_0^2 + y_0^2 + z_0}_{c_1}$$

















